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FINAL REPORT

AFOSR-81-0095

THE CHEMISTRY OF ANTIOXIDANT IN SOLID ROCKET PROPELLANTS

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March 1983

In this mini grant, the project director has focused his effort on the study of the propellant UPP. The composition of UPP is listed as follows:

CTBN- Carboxy-terminated butadieneacylonitrile,

PTECA- $C(COOH)_4$,

HX-868- Methylaziridine phthalate,

TMETN- Trimethyloethane trinitrate,

NMNA- N-nitroso-N-methyl-p-nitroaniline,

HMX- Cyclotetramethylene tetranitramine,

AP- Ammonium Perchlorate,

Al-Aluminium.

First attempt was to extract N-nitroso-N-methyl-p-nitroaniline (NMNA) from UPP by various solvents: benzene, carbon tetrachloride, methylene chloride, chloroform and dichloroethyl ether. At various experimental stages, we tried the above-mentioned solveents at different concentrations:95-99%. As compared with the previous studies of N-methyl-p-aniline (MNA), NMNA did not produce a peak due to the N-H at the methyl carbon in MNA by Fourier transformation infrared spectra. This led us to search for a unique peak in NMNA spectra. Using MNA and $(CH_3)_2NNO$ as a starting point, the appearance of a peak at 3453 cm^{-1} of MNA and disappearance of that peak in $(CH_3)_2NNO$

gave us the clue for an N-O peak search.

The propellant UPP for analysis was sliced into a thickness of 50 microns and was disolved in bebzene, carbon tetrachloride, methylene chloride, chloroform, dichloroethane, and diethyl ether. About 5.0 grams of the sliced sample was used for the solution. Soxhlet extraction apparatus was assembled with 250 ml flask. Extraction thimble size 22x80mm was used to contain the propelant in a Soxhlet extraction tube. A total volume of 100 ml solvent was uesd for each solvent extraction. The temperature of extraction has been varied from room temperature to 70^{o}C for a period of 8 to 24 hours.

The extract was evaporated to nearly dryness and the residue was re-dissolved by various solvents. Spectra were taken on the solution. A distinct peak at 3019 cm^{-1} is characteristic of NMNA.

An approach to this problem is to study the structure of NMNA. The project director and his undergraduate student research collaborators will continue this project. They propose an X-ray crystallographic study of this molecule during the summer of 1983 in order to determine the geometry and to study the microspectroscopic of NMNA.